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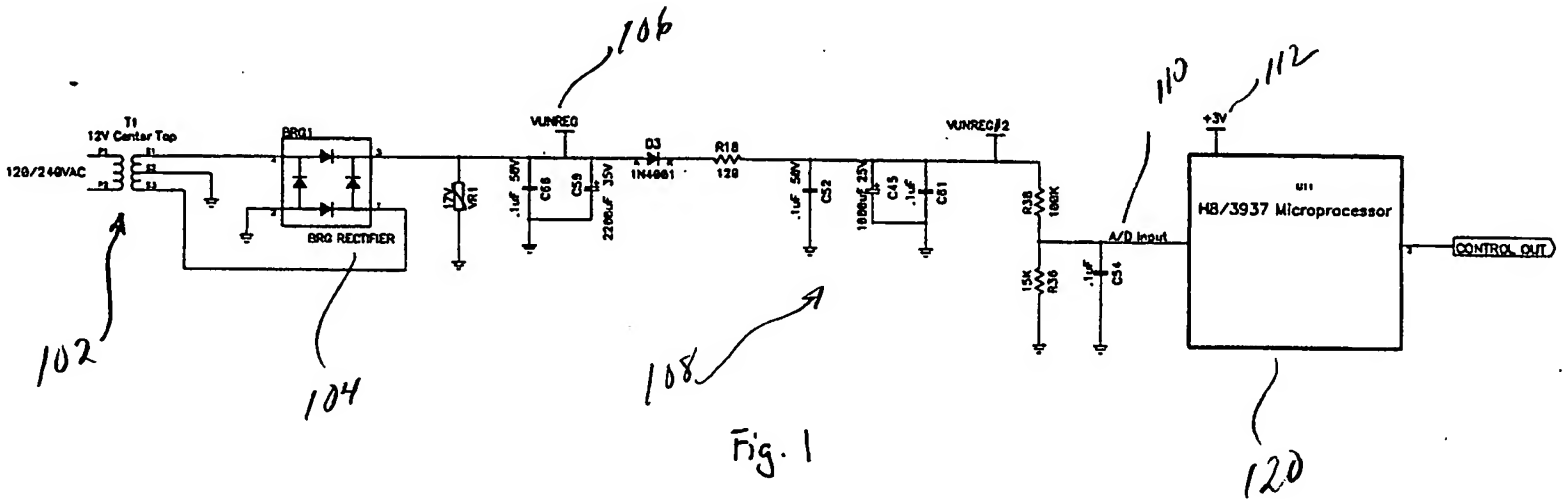
T1
12V Center Tap
120/240VAC
BRG1
BRG RECTIFIER
12V
VR1
.1uF 50V
C58
C59
2200uF 35V
VUNREG
D3
1N4001
R18
120
.1uF 50V
C52
VUNREG/2
1000uF 25V
C45
.1uF
C61
R38
100K
15K
R36
.1uF
C54
A/D Input
+3V
U11
HB/3937 Microprocessor
CONTROL OUT
102
104
106
108
110
112
120

Fig. 1

100

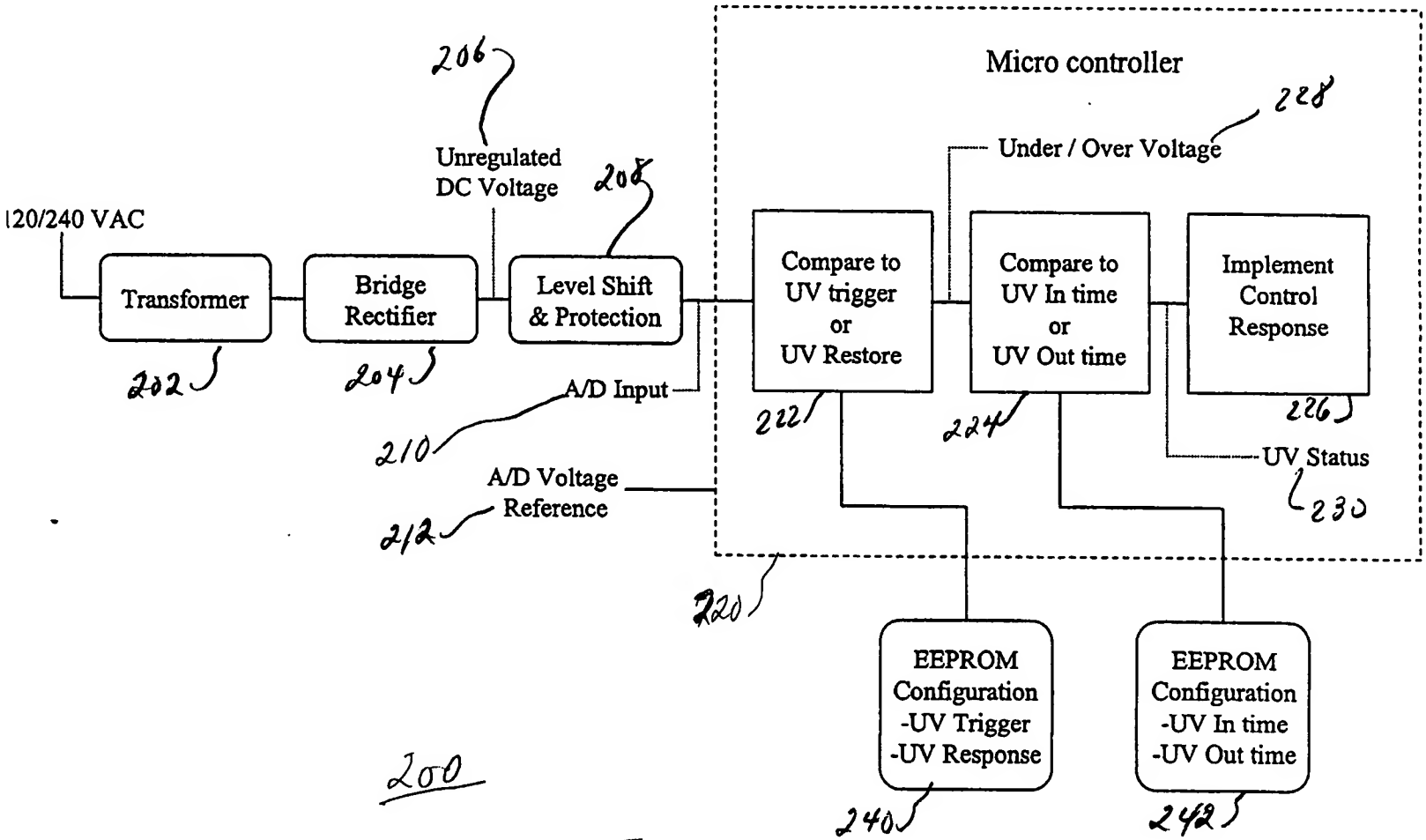
Micro controller
206
Unregulated
DC Voltage
208
228
Under / Over Voltage
120/240 VAC
Transformer
Bridge
Rectifier
Level Shift
& Protection
Compare to
UV trigger
or
UV Restore
Compare to
UV In time
or
UV Out time
Implement
Control
Response
202
204
A/D Input
210
222
224
226
UV Status
230
A/D Voltage
Reference
212
220
EEPROM
Configuration
-UV Trigger
-UV Response
EEPROM
Configuration
-UV In time
-UV Out time
240
242
200

Fig. 2

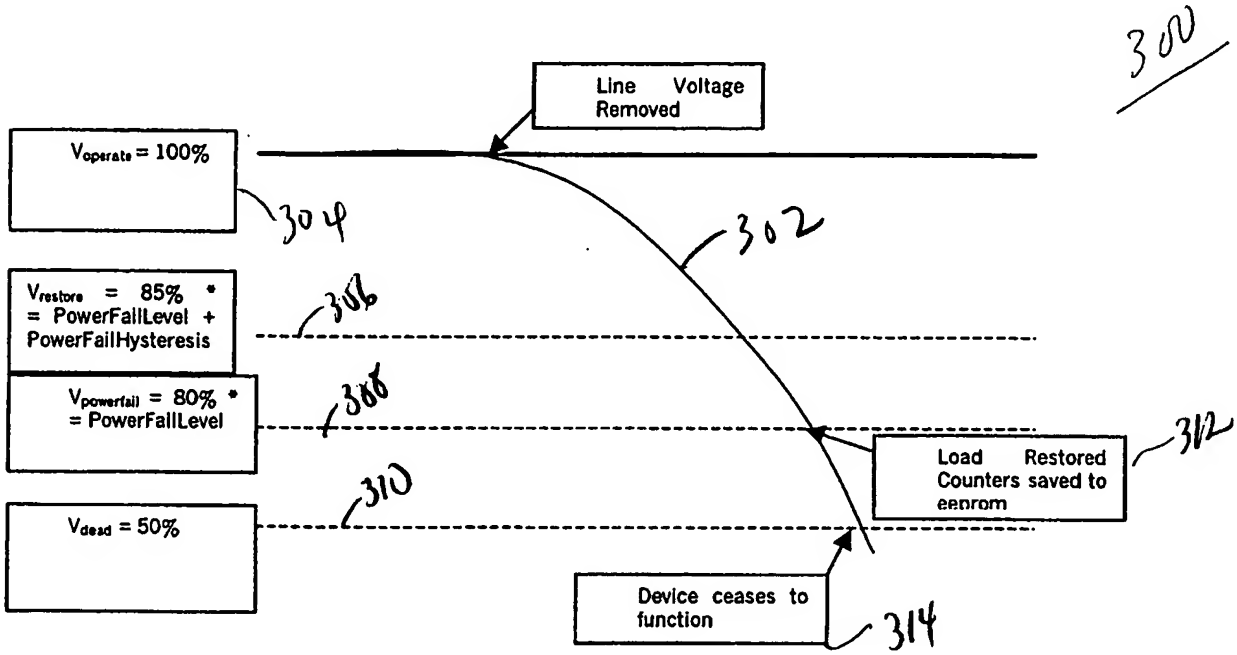
300
Line Voltage Removed
$V_{operate}$ = 100%
304
302
$V_{restore}$ = 85% * = PowerFailLevel + PowerFailHysteresis
306
$V_{powerfail}$ = 80% * = PowerFailLevel
308
310
V_{dead} = 50%
Load Restored Counters saved to eeprom
312
Device ceases to function
314

FIG. 3A

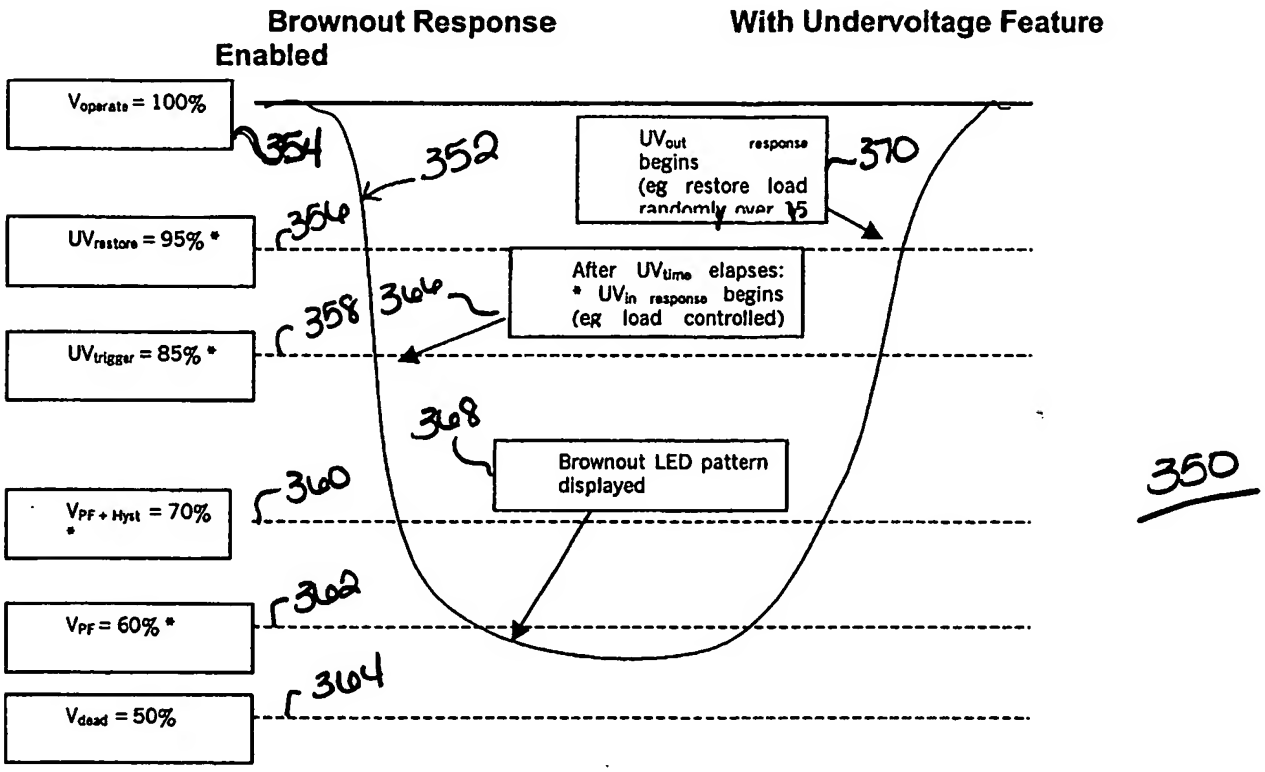
Brownout Response Enabled
With Undervoltage Feature
$V_{operate}$ = 100%
$UV_{restore}$ = 95% *
$UV_{trigger}$ = 85% *
$V_{PF + Hyst}$ = 70% *
V_{PF} = 60% *
V_{dead} = 50%
354
352
356
358
366
368
360
362
364
370
UV_{out} response begins (eg restore load randomly over 15
After UV_{time} elapses: * UV_{in} response begins (eg load controlled)
Brownout LED pattern displayed
350

Fig. 3B

Powerfail Response Enabled **With Undervoltage Feature**

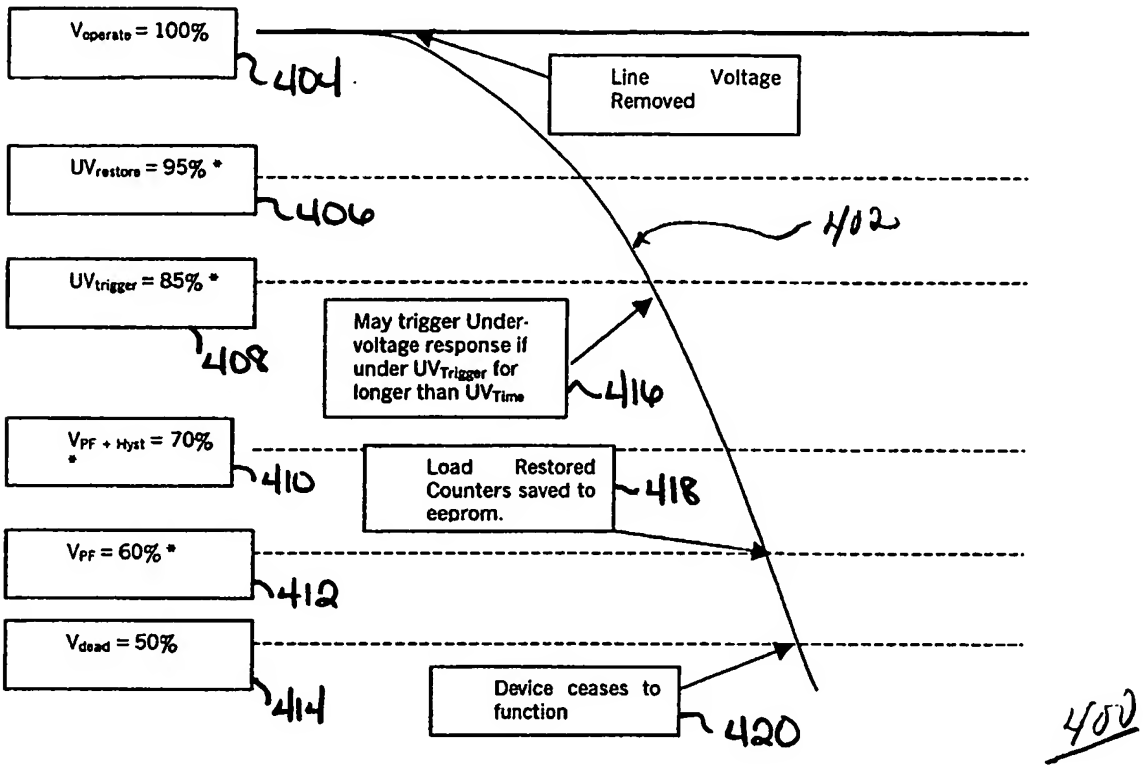

Fig. 4

Power Restore Response
With Undervoltage Feature Enabled

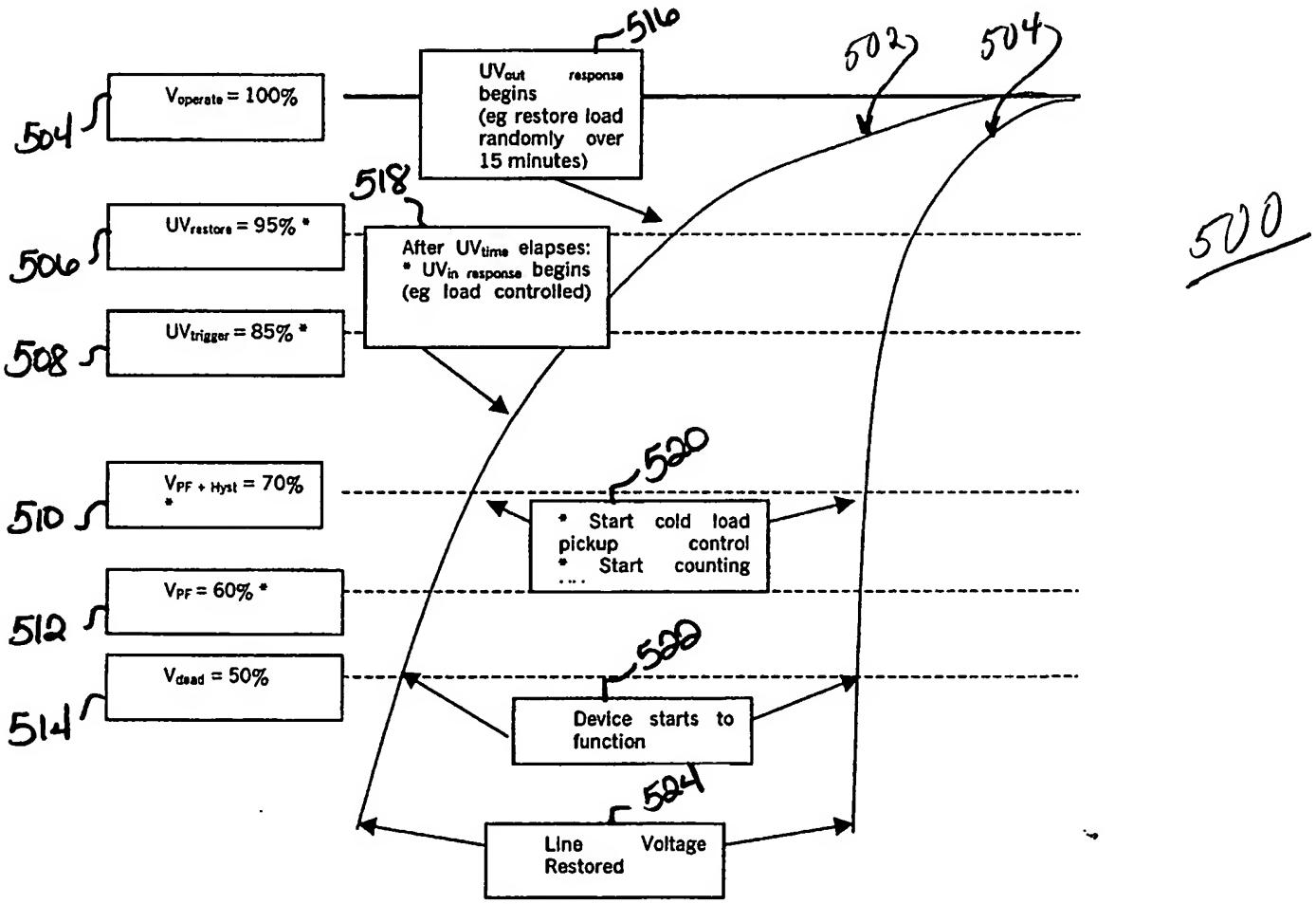

Fig. 5

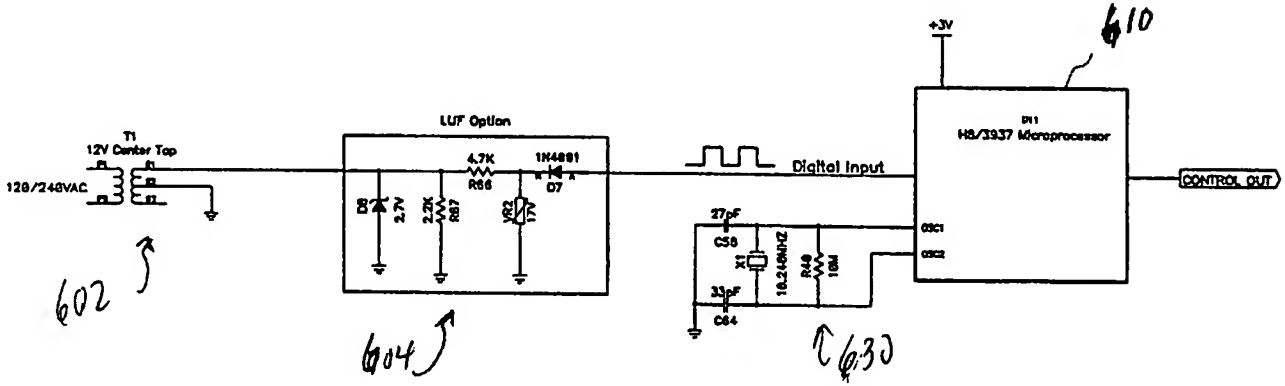
T1
12V Center Tap
120/240VAC
LUF Option
4.7K
R66
1N4891
D7
D8
2.7V
2.2K
R67
VR2
17V
+3V
U11
H8/3937 Microprocessor
Digital Input
CONTROL OUT
27pF
C58
X1
18.245MHZ
R48
10M
33pF
C64
OSC1
OSC2
602
604
610
630

Fig. 6

600

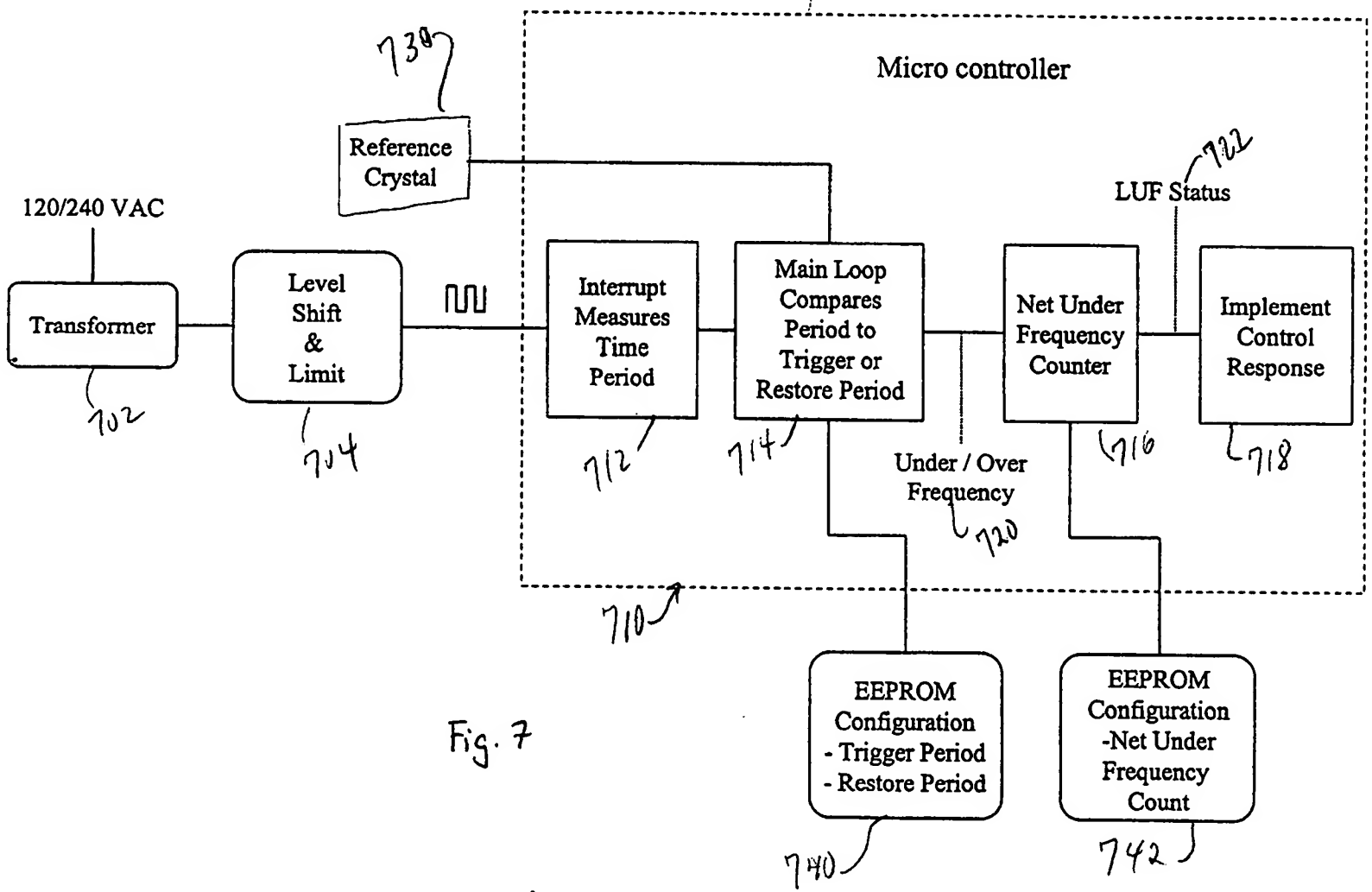
730
Micro controller
Reference Crystal
120/240 VAC
LUF Status
732
Transformer
Level Shift & Limit
Interrupt Measures Time Period
Main Loop Compares Period to Trigger or Restore Period
Net Under Frequency Counter
Implement Control Response
Under / Over Frequency
702
704
712
714
716
718
720
710
EEPROM Configuration - Trigger Period - Restore Period
EEPROM Configuration -Net Under Frequency Count
740
742

Fig. 7

700

1.1.4.1. Normal Operation (LUFStatus = 0)

For each sample, the length of the cycle is compared to the UFT_Trigger. If the cycle length is greater or equal to the trigger, than NUFCount is incremented. If the cycle length is less than the trigger than NUFCount is decremented.

If NUFCount reaches NUFTrigger, then a under frequency condition has been detected and then the LUFInResponse is implemented and the LUFStatus is set.

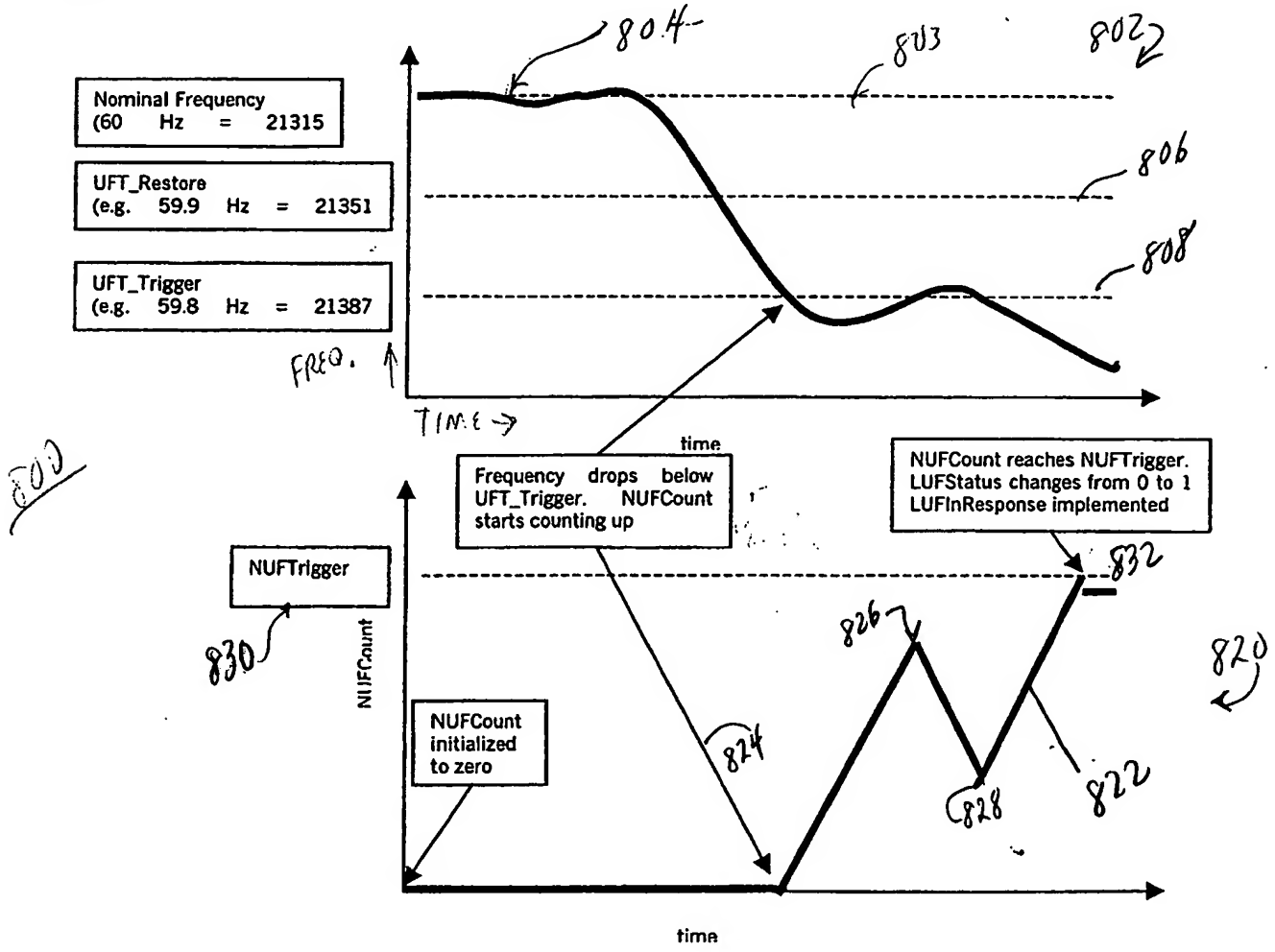

Fig. 8

1.1.4.2. Underfrequency Operation (LUFStatus = 1)

Once LUFStatus is set, then each cycle is compared to UFT_Restore. If the cycle length is greater or equal to the trigger, than NUFCount is incremented. If the cycle length is less than the trigger than NUFCount is decremented.

If NUFCount reaches zero, then the under frequency condition has ceased, and then the LUFOutResponse is implemented and the LUFStatus cleared.

The NUFCount is always in the range of 0..NUFTrigger.

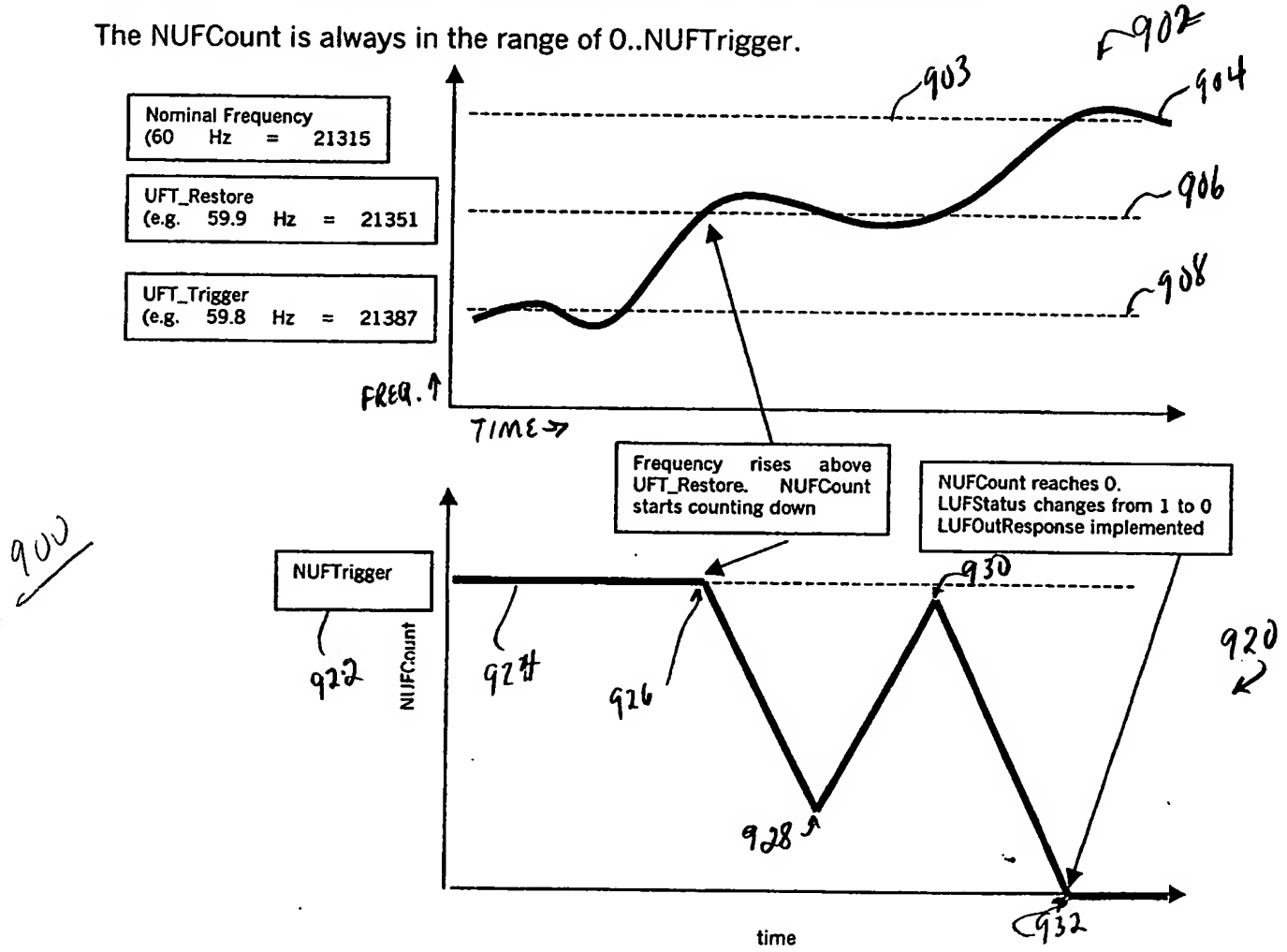

Fig. 9

1.1.5. OPERATION (ALGORITHM)

For each power line cycle:

If LUFStatus is Normal

If MLP >= UFT_Trigger

Increment NUFCount

Else

Decrement NUFCount

If NUFCount>=NUFTrigger AND NUFTrigger is non-zero

Set LUFStatus to Under-Frequency

Increment LUFCount

Perform LUFInResponse (typically control all loads)

Else LUFStatus is Under-Frequency

If MLP >= UFT_Restore

If (NUFCount<NUFTrigger)

Increment NUFCount

Else

Decrement NUFCount

If NUFCount is Zero or NUFTrigger is zero

Set LUFStatus to Normal

Perform LUFOutResponse (typically restore all loads)

Fig. 10